



# Objectives:

- To facilitate students' ability to communicate mathematically.
- Understand the components of a problem solving approach in your classroom.
- Understand the role of the teacher when implementing a problem solving approach.

# Give One, Get One.

- What are the key elements to an effective maths lesson?

# Classroom Discussions



Generating mathematical talk that supports  
mathematics learning

# What is productive mathematical talk?

Talk that

- supports development of student reasoning
- supports improvement in students' ability to communicate their thinking
- helps students to respond to the reasoning of others
- may lead to changes in a student's thinking

# Why use productive mathematical talk?

- In groups of 3. Read the 5 major reasons why talk is critical to teaching and learning.
- Discuss these in your group.



# Why use productive talk in mathematical classrooms?

Five major reasons why talk is critical to teaching and learning:-

- Talk can reveal understanding and misunderstandings.
- Talk supports robust learning by boosting memory.
- Talk supports deeper reasoning .
- Talk supports language development.
- Talk supports development of language skills.





# Teacher Tools to Promote Productive Classroom Discussions





# Talk Moves (Chapin, O'Connor & Anderson 2009)

- *Re-voicing*: - repeating what students have said and then asking for clarification  
*So you're saying... Is that right?*
- *Repeating*: asking a student to restate someone else's reasoning  
*Can you repeat what she just said?*
- *Reasoning*: asking students to apply their own reasoning to someone else's reasoning  
*Do you agree or disagree, and why?*
- Adding on – prompting students for further participation  
*Would someone like to add something more to that*
- Waiting – using wait time  
*Take your time – we'll wait.*

# Setting Classroom Norms

## Classroom Discussions



As **Speakers** we will:

1. Talk loud enough for others to hear.
2. Turn to talk to the class.
3. Share different ideas.
4. Explain our ideas.
5. Agree and disagree with ideas, not each other.

As **Listeners** we will:

1. Ask speakers to speak up.
2. Show speakers we are listening.
3. Listen to understand.
4. Ask questions to make more sense of the idea.
5. Think carefully about all speakers' ideas.

# Two Major Goals of Setting Up Classroom Talk Norms

- **Respectful Discourse** – talk is respectful when each person's ideas are taken seriously; no one is ridiculed or insulted and no one is ignored or browbeaten.
- **Equitable Participation** – participation is equitable when each person has a fair chance to ask questions, make statements, and express his or her ideas. Academically productive talk is not just for the most vocal or the most talented students.

# Problem Solving Approach





# What is problem solving?

- It is about finding and explaining solutions, not just answers.
- It is about making explicit connections for students across all the maths strands, rather than learning strands in isolation.

## Purpose of Problem Solving

- By solving problems students get a better understanding of the nature of mathematics.



# The NZ Curriculum:

- *In a range of **meaningful contexts**, students will be engaged in thinking mathematically and statistically. They will **solve problems** and model situations that will require them to...*



# Worthwhile Tasks

- Have a mathematical focus

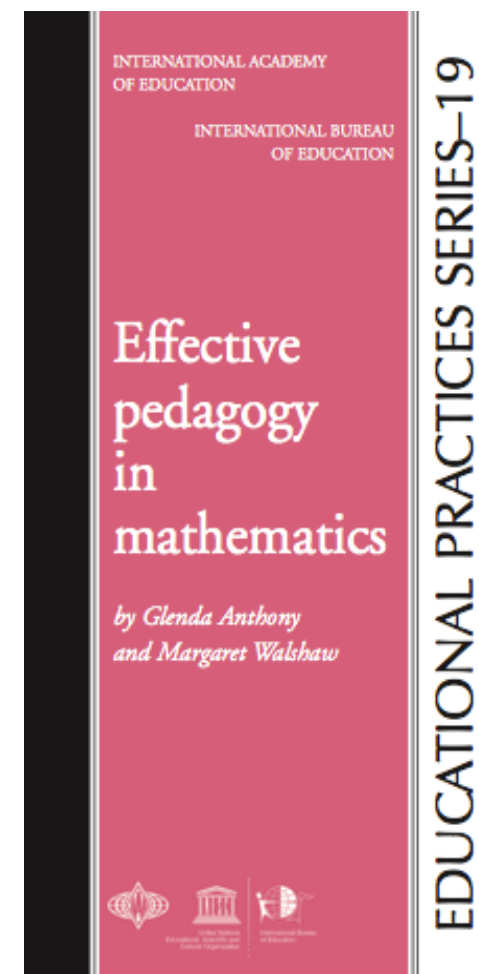
*Require students to think with and about important mathematical ideas.*

- Problematic tasks

*Make and test conjectures, pose problems, look for patterns, and explore alternative solution paths.*

- Practice Activity

*Improve computational fluency, problem-solving skills, or conceptual understanding.*





<https://www.youcubed.org/wim-day-1/>

# The Collaborative Problem Solving Approach

## The 5-Part Lesson for Problem Solving

- Launch the problem
- Independent thinking time
- Small group sharing
- Whole class sharing (congress/gallery walk around)
- Self-assessment/ reflection

# The structure of this approach is intended to provide positive opportunities for:

- Risk taking
- Mathematical language development
- Peer coaching
- Teacher's role as a facilitator and observer
- Effective learning
- Mixed ability class teaching

**Gould, P. (1993) Co-operative Problem Solving in Mathematics**, Mathematical Association of N.S.W. Australia. ISBN 0-7310-1371-9

# 1. Launch the Problem -

## Even More Pizzas and Things

The Pizza Place has three tables. The biggest one seats three times as many people as the smallest one. The middle sized table seats twice as many people as the smallest one.



On Tuesday night three-quarters of the seats were taken. Then twelve more people arrived. Unfortunately there were only enough seats for half of them.

How many people can sit at the smallest table?

# Consider

- How important was it for you to have individual thinking time?
- How much did you value working with others in a group; sharing your ideas?



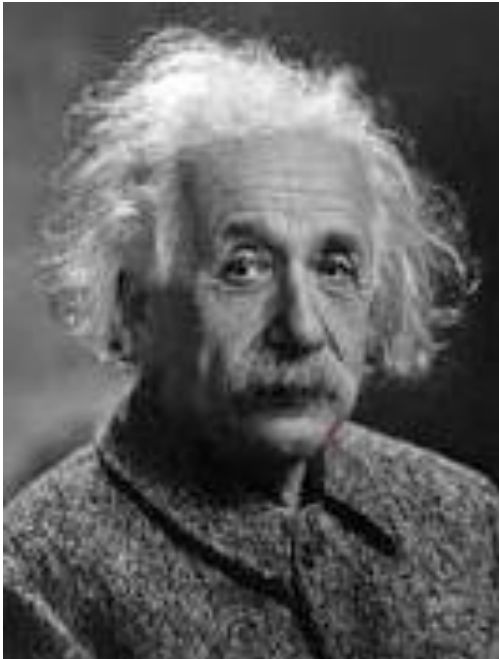
# The 5-Part Lesson- Role of the Teacher – The Five Practices

# The 5-Part Lesson- Teacher's Role

		Teacher's Role – The Five Practices
Part 1	Launch the Problem	<b>Anticipate</b> misconceptions, likely responses, key knowledge, equipment/diagrams, extension
Part 2	Independent thinking time	<b>Monitor</b> and observe students' actual responses to the tasks while students work on the tasks independently, pairs or small groups
Part 3	Small Group Sharing	Provide scaffolding. <b>Monitor, select and sequence</b> who will report back
Part 4	Whole Group Sharing	<b>Connect</b> and develop key ideas and maths vocabulary
Part 5	Student Self-Assess	Provide helpful feedback and co-construct next steps.



# Thought for the Day



*It's not that I'm so smart,  
it's just that I stay with  
problems longer.*

Albert Einstein

# Reason 1- Talk can reveal understandings and misunderstandings

If students talk about the content they're studying, we can see more clearly what they don't understand.....and what they do understand. This helps teachers adjust their teaching. Some call this ***formative assessment***. Getting students to talk about mathematical content is one of the best ways to engage in formative assessment. An additional benefit is that students may themselves realise what they don't understand and what they do understand. This allows them to adjust their own reasoning, and over time it may improve their metacognitive abilities.

Classroom discussions in maths (3rd edition)– Susanne Chapin

## **Reason 2 – Talk supports robust learning by boosting memory**

Talk is a rich source of information and plays a part in many kinds of memory. When we hear and talk about concepts, procedures, and application, our memories have more to work with. In classroom discussions, as multiple students discuss the same content, everyone benefits by hearing that content verbalised in different ways, particularly students who may need more time to process mathematical ideas. The social aspect of talk also helps students remember content and argumentation: If the teacher makes a claim, some students remember it; some don't. If a student makes a claim and another student contests it or agrees with it, the whole learning event becomes more memorable because of its social significance.

Classroom discussions in maths (3rd edition)– Susanne Chapin

## **Reason 3 – Talk supports deeper reasoning**

Learning to reason well takes time. Both children and adults need practice to work out the logic of their ideas and to put together a persuasive argument. Practice with reasoning requires that we have other people to reason with- people who can respond to our own reasoning and share their reasoning with us. In the classroom, teachers can give students that practice by using talk in strategic ways.

Classroom discussions in maths (3rd edition)– Susanne Chapin

## **Reason 4- Talk supports language development**

When talk is used intensively in classes, students may get a richer sense of what words and phrases mean and when to use them. Their control of complex grammar also improves, in speaking and in reading. For students who are English learners, this is particularly crucial.

Classroom discussions in maths (3rd edition)– Susanne Chapin



## Reason 5- Talk supports development of social skills

When teachers use classroom talk a great deal, it gives students a chance to learn about respect and kindness. They learn that it takes time to understand someone else's reasoning, and that they have to be patient as others struggle to clarify. They also learn that they have to work to make their *own* reasoning clear. Over time, this improves students' social skills and ability to be patient and cooperative with others- and with themselves.

Classroom discussions in maths (3rd edition)– Susanne Chapin